National Aeronautics and
Space Administration

Communications

Space Optical Communications Using Laser Beams

Amplify and Return a Laser Beam Received by a Satellite

NASA has developed a new technology for space optical communications, including communications from the Earth to spacecraft in Earth orbit and in deep space, such as at the moon and Mars. The innovation changes the architecture of space optical communications so that a new laser beam pointing technology is used to improve optical data transmissions from spacecraft. This technology will detect a signal laser beam and then return a modulated laser beam to the ground terminal or other transmitter station in a new way. This new design can replace current methods that either use a laser together with a pointing, acquisition, and tracking (PAT) procedure in the space craft or a powerful ground-based laser with a retro-reflector in the spacecraft.

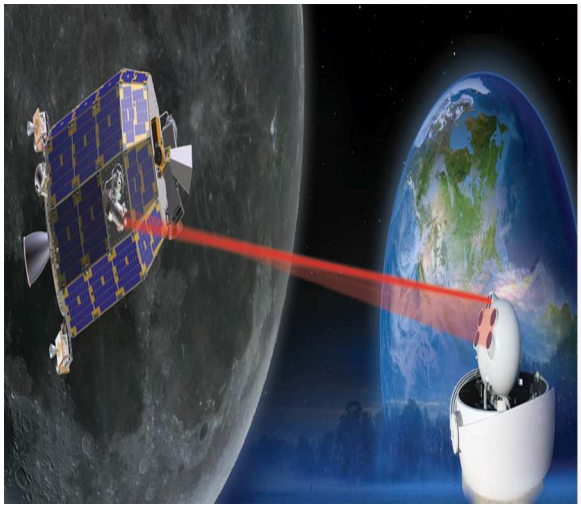
BENEFITS

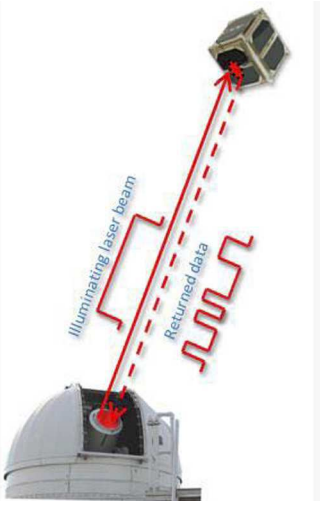
- The pointing uses a cats eye lens and a VCSEL (vertical-cavity surface-emitting laser) array
- Minimal maintenance required
- Components are simple, static, and reliable
- No electrical safety issues
- Increase in communications performance
- Compact, with no moving parts
- Does not need a vibration isolation platform

technology solution

THE TECHNOLOGY

The Space Optical Communications Using Laser Beams (SOCULB) will provide a capability to amplify a laser beam that is received in a modulating retro-reflector (MRR) located in a satellite in low Earth orbit, and also to improve the pointing procedure between Earth and spacecraft terminals. This technology will use laser arrays to strengthen the reflected laser beam from the spacecraft. The system does not pose any electrical safety issues, as microelectronic components are used that operate at voltages below 10 volts and with currents below 100 miliamps (mA). The laser radiation received at the ground terminal will not pose a danger to the human health because of the low transmitted power. In addition, the vertical cavity surface emitting lasers chosen for this application can operate in the 1550 nano-meter (nm) wavelength range, where the maximum permitted exposure level for the eyes is orders of magnitudes higher than at other wavelengths. This simplifies testing of the devices on the ground. Wavelengths in the 1550 nm range are the usual wavelengths for optical communications.





Left : Schematic of Downlink from Lasercom Terminal on Host Spacecraft

Right: Schematic of Downlink from a Satellite using MRR Technology

APPLICATIONS

The technology has several potential applications:

- CubeSat communications
- Spacecraft industry
- Small satellites industry

PUBLICATIONS

Patent Pending

More Information

National Aeronautics and Space Administration

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